

IN THE UNITED STATES  
PATENT AND TRADEMARK OFFICE

**PATENT APPLICATION**

Applicant: **Shannon, et al.**

Case: **8824/ETCH/DRIE**

Serial No.: **10/823,371**

Filed: **April 12, 2004**

Examiner: **Arancibia, Maureen Gramalgia**

Group Art Unit: **1763**

Confirmation No.: **4850**

Title: **DUAL FREQUENCY RF MATCH**

Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

S I R:

**DECLARATION OF STEVEN C. SHANNON UNDER 37 CFR §1.132**

I, Steven C. Shannon, declare as follows:

1. I am citizen of the USA, and I reside at 1501 Trollman Avenue, San Mateo, CA 94401.
2. I graduated in 1995 from University of Michigan in Ann Arbor, MI, with a Bachelor of Science in Engineering degree in Nuclear Engineering; in 1997 from University of Michigan in Ann Arbor, MI, with a Masters of Science in Engineering degree in Nuclear Engineering; and in 1999 from University of Michigan in Ann Arbor, MI, with a Doctor of Philosophy in Engineering degree in Nuclear Engineering.
3. Since 1999, I have been working in the field of low pressure RF plasma discharges for microelectronics fabrication; I have been employed by Applied Materials, Inc., since 1999, and all of this time has been spent in this specialty.
4. Since 2000, I have been acting in the capacity of adjunct faculty at San Jose State University where I have instructed students in materials science and engineering.

with particular focus on integrated circuit fabrication technology and plasma science. I have been employed by San Jose State University since 2000, and all this time has been spent in this specialty.

5. I have been granted at least 4 US patents in the RF and plasma science field.

6. I am one of the co-inventors of the subject matter described and claimed in the above-identified patent application and I am familiar with the disclosure and pending claims in the above-identified patent application.

7. The disclosure of the above identified application describes a match circuit design for coupling two frequencies to a common electrode that provides a match tune space that can be varied for either frequency input by shunt component tuning without the undesirable side-effect of shifting the other frequency's tune space. Consequently, the first and second frequency's tune spaces may be independently controlled with no interaction in the match circuit.

8. The match circuit design in the present application may have at least one fixed set of series components and at least one variable shunt component connected to ground.

9. Other configurations of match circuit designs for coupling two frequencies to a common electrode and having at least one fixed set of series components and at least one variable shunt component connected to ground may be designed that do not provide a first match tune space that can be varied without affecting a second match tune space. Therefore, fixed series elements in the respective tuning portions of the dual frequency match circuit do not necessarily provide respective tune space independence.

10. As an example, a Smith chart is attached hereto as Exhibit A corresponding to a first match circuit (line 100) according to embodiments of the present invention compared to a second match circuit (lines 102 and 104) having fixed series components and a variable shunt to ground that does not comport with the principles of the present invention. This Smith chart represents an actual model derived from proprietary Applied Materials, Inc. parallel lump element match circuit analysis performed in the MathCAD software package.

10. The Smith chart shows a tune space graph for the first match circuit (line 100) that overlaps and appears as a single line – corresponding to no shift in one tune space when varying the shunt components of the other tuning portion of the match circuit. The Smith chart further shows a tune space graph for the second match circuit (lines 102 and 104) that clearly diverges – corresponding to a tune space shift for one frequency as a function of the variation of the other frequency's shunt capacitor position. Thus, the first tune space provided by the second match circuit modeled in Exhibit A cannot be varied without affecting the second match tune space provided by the match circuit.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date September 12, 2007



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Steven C. Shannon